

REMARKS/ARGUMENTS

Claims 17 and 38-52 were allowed in the Office Action dated February 12, 2004. Hence none of the following remarks apply to these allowed claims.

Claims 1-10 and 16 stand rejected as being unpatentable over the combined teachings of Yin (6,525,818) and Ushio (6,489,624). In making the rejection, the Examiner stated (see bottom of page 2 of the Office Action) that Yin discloses illuminating the wafer with a beam of electromagnetic radiation having a majority of energy polarized in a direction other than parallel to the longitudinal direction of the feature. As support, the Examiner cited to Yin's column 7, lines 38-42 and column 7, lines 58-63 which is reproduced below (emphasis added):

The light passing through this optical system 110 and incident upon the alignment marks 34 and 34' on semiconductor wafer 18 is linearly polarized, with the direction of polarization in the plane perpendicular to the optical axis rotating in a cyclical manner. At one point in time, the electric field will be parallel to the major axis of opening 31 in reticle 32. A period of time later the electric field will be parallel to the major axis of opening 33 in reticle 32.

The phase locked circuits 60a, 62a, 64a, and 66a can be adjusted to be sensitive to light which is polarized such that the electric field of the light is parallel to a major axis of the alignment marks 34 or 34', or the phase locked circuits 60a, 62a, 64a, and 66a can be adjusted to be sensitive to light which is polarized in a direction which results in the largest obtainable value of the desired observable signal, or in the largest obtainable value for the ratio of the desired observable signal to the undesired observable signal.

In the above-quoted text, which the Examiner is relying upon for the rejection of Claim 1, Yin explicitly states that the signal to be observed is "such that the electric field of the light is parallel to a major axis of the alignment marks 34 or 34'" (emphasis added). Yin's need to observe parallel orientation of the alignment

marks is an important aspect of Yin's invention, because Yin's system "determines and adjusts the alignment between features which have been formed on a semiconductor wafer and features on a mask which is being projected onto the semiconductor wafer" (see Yin's Abstract). Therefore, Yin's teachings relate to alignment of a wafer to a mask, and Yin's system is deliberately built to be sensitive to a direction parallel to the alignment marks.

Applicants submit that Yin's teachings are improperly combined with Usho's teachings for at least four reasons, as follows. First, measuring Yin's signal in directions other than parallel to his alignment mark(s) is nowhere suggested by Yin. In fact, non-parallel measurement, in the manner suggested by the Examiner would render Yin's system inoperative for its intended purpose. Specifically, Yin's alignment system appears unlikely to work for its intended purpose (to align a wafer to its mask) when the measured signal results from an orientation other than parallel.

Second, Yin requires his direction of polarization to be rotating in a cyclical manner. There is no indication whatsoever in Ushio's teachings as to how a signal that results from rotating polarization of incident light is to be processed. The Examiner has not provided any reason whatsoever for a skilled artisan to have a reasonable expectation of success in applying Ushio's measurement method to Yin's system.

Third, it appears that a significant re-design of Yin's system is required, to make a workable combination that uses Yin's signal from rotating polarization in Ushio's method which measures intensity regardless of polarization (as stated in the prior Amendment dated January 14, 2004 in the bottom half of page 12, "it appears that Ushio et al.'s probe light 33 could be just as easily unpolarized as it could be polarized").

Fourth, the Examiner's only reason for combining the teachings of Yin with the teachings of Ushio was stated in the middle of page 4 of the Office Action, as being "to enable measuring intensity of a portion of the beam reflected by the wafer for reasons discussed in Ushio et al." Applicants submit that the Examiner's motivation is insufficient because there is no indication whatsoever as to why a skilled artisan,

on reviewing Yin's wafer alignment system would be motivated to convert it into a wafer evaluation system. As noted above, Yin's signal is merely used to align the wafer to the mask. There is no reason why a skilled artisan would believe that Yin's signal can be effective in evaluating a feature in the wafer (as opposed to merely aligning to Yin's mark). Following the Examiner's logic, Yin's teachings can be combined with any prior art reference, which is clearly overbroad.

Claim 1 is amended to recite that the direction of polarization is "selected" thereby to clearly distinguish over the rotating polarization of Yin. As would be apparent to the skilled artisan, rotating polarization does not have a deliberately selected direction. Instead, as noted by Yin (see the above-quoted text), light with rotating polarization continuously changes its direction and no particular direction is necessarily preferred. Support for requiring a "selected" direction of polarization as recited in Claim 1 is to be found throughout the originally-filed application, including, for example, page 7, lines 21-22. For example, as stated at page 7, line 21, "polarization direction P is deliberately selected to be ..."

Claim 1 is further amended to add a limitation based on Claim 6 which has been canceled. Specifically, Claim 1 now requires the presence of a layer between the beam source and the feature, which layer is at least partially transmissive. Support for this amendment to Claim 1 can be found throughout the originally-filed application, including, for example, the layer 28 illustrated in FIG. 4, page 6 lines 27-28, page 10 line 4, page 11 lines 24-26, page 13 lines 3-7, page 17 line 27 to page 18 line 5, and page 20 line 25 to page 21 line 6. Claim 1 also requires measuring a change in reflectance of the feature due to heat transfer through the feature. Support for this amendment to Claim 1 can also be found throughout the originally-filed application, including, for example, page 4 lines 2-4, page 4 lines 14-17, page 10 line 31 to page 11 line 2, page 11 lines 8-9.

In view of the amendment of Claim 1, the Examiner's rejection of Claim 6 (which has been incorporated into Claim 1) is now applicable to Claim 1. Applicants hereby submit that the Examiner has failed to take note of and answer Applicants' argument regarding heat transfer that was made in the prior amendment dated

January 5, 2004. Specifically, Applicants had stated at the top of page 16 of this prior amendment that the word "heat" is not found anywhere in the Examiner's remarks. This prior argument by Applicants is now applicable to amended Claim 1, and it continues to be relevant, because even in the most recent Office Action dated February 12, 2004, **the Examiner did not use the word 'heat' anywhere in the entire Office Action.**

Furthermore, as previously stated in Applicants' prior amendment dated January 5, 2004, in the middle of page 16, the Examiner analogized layer 64 of Ushio et al.'s structure as being the trace of reflective material and also as the layer that is partially transmissive. This inconsistency in the Examiner's characterization of a single layer 64 as being two different layers one reflective and the other partially transmissive has not been explained. **The Examiner cannot characterize a single layer in Ushio's disclosure as being two different layers.**

Moreover, as previously stated in Applicants' prior amendment dated January 5, 2004, in the middle of page 16, Ushio's layer 64 appears to be a **dielectric layer** (e.g. 390 nm thick SiO₂ is identified at column 22, line 32 of Ushio et al). Hence, as would be apparent to the skilled artisan, Ushio's layer 64 is nearly transparent to Yin's light (of rotating polarization as noted above). Shining Yin's light on Ushio et al.'s layer 64 would not cause any measurable heating in layer 64. Also, such a layer 64 has very low thermal conductivity, so any heat flow in Ushio's layer 64 is negligible. In contrast to Ushio's layer 64, Claim 1 (as amended) requires the layer to be **thermally conductive**.

In view of the above reasons, Claim 1 is believed to be patentable over the combined teachings of Yin and Ushio. Claims 2-10 and 16 depend from Claim 1 and are therefore believed to be patentable for at least the above-discussed reasons. If the Examiner decides to allow Claim 1, Applicants hereby request the Examiner to also consider and allow withdrawn Claims 11-15 that depend from Claim 1.

Also, new Claims 53-57 depend either directly or indirectly from Claim 1 and are also believed to be patentable for at least the same reasons as Claim 1. Support for these new claims is found throughout the originally-filed application, including, for

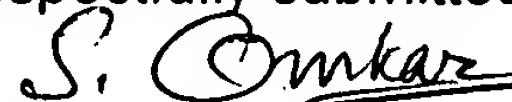
example, page 6 lines 27-28, page 10 line 4, page 13 lines 6-7, page 17 line 29, and page 20 line 25 to page 21 line 3. See also page 1, line 27 to page 2 line 5. The just-quoted citations also support new Claims 58- 62.

Finally, Applicants note that despite having filed a Request for Continued Examination (RCE), the Examiner has continued to make **unsupported statements** in rejecting Applicants' claims. For example, the Examiner stated in the middle of page 3 of the Office Action that Ushio discloses that "the beam has a majority of energy polarized in a direction at least substantially **perpendicular** to the longitudinal direction" (emphasis added). Applicants hereby request the Examiner to cite by column and line number where in Ushio's disclosure any teaching of "perpendicular" polarization is to be found. In the absence of such teaching, Applicants submit that the Examiner failed to make a prima facie case of rejection of Claim 7 (prior to the above amendment). For this reason, Applicants are now adding a new independent Claim 63 that explicitly recites this limitation. If the Examiner is unable to find prior art on perpendicular polarization, then Claim 63 and its dependent Claims 64-65 must be allowed.

For the reasons noted above, Applicants respectfully request allowance of all pending claims. Should the Examiner have any questions concerning this response, the Examiner is invited to call the undersigned at (408) 982-8200, ext. 3.

**Via Express Mail Label No.
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Respectfully submitted,



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